(1) Empty; and
(2) In a hold space flooded to the summer load draft of the vessel.

§ 154.471 Design criteria.

(a) The cargo tank support system must be designed:
(1) For the loads in § 154.406(a);
(2) To not exceed the allowable stress under this part at a static angle of heel of 30°;
(3) To withstand a collision force equal to at least one-half the weight of the cargo tank and cargo from forward and one-quarter the weight of the cargo tank and cargo from aft; and
(4) For the largest resulting acceleration in Figure 1, including rotational and translation effects.
(b) The cargo tank support design loads in paragraph (a) of this section may be analyzed separately.

§ 154.476 Cargo transfer devices and means.

(a) If a cargo pump in a cargo tank is not accessible for repair when the cargo tank is in use, the cargo tank must have an additional means of cargo transfer, such as another pump or gas pressurization.
(b) If cargo is transferred by gas pressurization, the pressurizing line must have a safety relief valve that is set at less than 90 percent of the tank relief valve setting.

CARGO AND PROCESS PIPING SYSTEMS

§ 154.500 Cargo and process piping standards.

The cargo liquid and vapor piping and process piping systems must meet the requirements in §§ 154.503 through 154.562, Subparts 56.01 through 56.35, §§ 56.50–20 and 56.50–105, and Subparts 56.60 through 56.97 of this chapter.

§ 154.503 Piping and piping system components: Protection from movement.

Where thermal movement and movements of the cargo tank and the hull structure may cause stresses that exceed the design stresses, the piping and piping system components and cargo tanks must be protected from movement by:
(a) Offsets;
(b) Loops;
(c) Bends;
(d) Mechanical expansion joints including:
(1) Bellows;
(2) Slip joints;
(3) Ball joints; or
(e) Other means specially approved by the Commandant (G–MSO).

[CGD 74–289, 44 FR 26009, May 3, 1979, as amended by CGD 82–063b, 48 FR 4782, Feb. 3, 1983]

§ 154.506 Mechanical expansion joint: Limits in a piping system.

Mechanical expansion joints in a piping system outside of a cargo tank:
(a) May be installed only if offsets, loops or bends cannot be installed due to limited space or piping arrangement;
(b) Must be a bellows type; and
(c) Must not have insulation or a cover unless necessary to prevent damage.

§ 154.512 Piping: Thermal isolation.

Low temperature piping must be thermally isolated from any adjacent hull structure to prevent the temperature of that structure from dropping below the minimum temperature for the hull material under § 154.170.

§ 154.514 Piping: Electrical bonding.

(a) Cargo tanks or piping that are separated from the hull structure by thermal isolation must be electrically bonded to the hull structure by a method under paragraph (c) of this section.
(b) A pipe joint or a hose connection fitting that has a gasket must be electrically bonded by a method under paragraph (c) of this section that bonds:
(1) Both sides of the connection to the hull structure; or
(2) Each side of the connection to the other side.
(c) An electrical bond must be made by at least one of the following methods:
(1) A metal bonding strap attached by welding or bolting.
(2) Two or more bolts that give metal to metal contact between the bolts and the parts to be bonded.
(3) Metal to metal contact between adjacent parts under designed operating conditions.